## *Cactoblastis cactorum* Activities Report for March 2006

This blended report briefly summarizes individual reports received from all researchers and program cooperators working on different aspects of the program to stop the spread of the cactus moth.

**FUNDING.** Funds from SAGARPA through a signed Cooperative Service Agreement with NAPPO were received and deposited into a USDA account by 1 March. Also, during this month, the funds from APHIS and SAGARPA for the Reimbursable Interagency Agreement for Cactus moth research by ARS was completed and workplan forwarded.

**COMMUNICATIONS**. A conference call was held between SAGARPA (Gustavo González Villalobos and Aurturo Bello), NAPPO (Ian McDonell), and APHIS-PPQ (Joel Floyd, Stephanie Bloem, Ken Bloem) to discuss how we will communicate and progress with the program.

**SURVEY**. All the data from the 2005 surveys have now been entered into the NAPIS database. For 2006, Arizona, Louisiana, Mississippi, South Carolina, and Texas will be doing trapping surveys with the experimental lure, and California and New Mexico will be doing outreach at area nurseries. The Mississippi State University GeoResources Institute's Cactus moth detection website was updated. Richard Brown is received specimens from Puerto Rico for DNA analysis.

**MEETINGS/BRIEFINGS**. Joel Floyd attended the Mexico-US Bi-National Commission meeting on natural resources in Washington DC to provide a 15 minute cactus moth briefing, with Sharon Gross of USGS to the undersecretary of Interior and her counterpart at SEMARNAT. Because of discussions about water issues and the short time allotted, the briefing was cancelled during the meeting. Outreach materials and DVD's produced by the IAEA were distributed to participants.

**REGULATION**. Two regulatory work-plans are now in the APHIS Regulatory Analysis and Development staff. One is the continental domestic regulation on *Opuntia*, *Consolea*, *Cylindropuntia*, *Nopalea*, prohibiting movement of live plant material from Alabama, Florida, Georgia, and South Carolina. The other tightens up existing territorial and Hawaiian restrictions and adds a prohibition of fresh plant material from foreign countries that have *Cactoblastis cactorum*.

**OUTREACH**. Additional videos and DVD's were received from the IAEA to be distributed to interested parties. Some of these materials in addition to printed pest alerts were sent to the Texas Cooperative Extension range specialist who gave a talk on cactus moth to the Texas Cattle Association. An article on cactus moth and the USDA efforts was requested by the Chihuahuan Desert Research Institute, was provided, and will be published in their May newsletter.

**EQUIPMENT:** Nikon and Leica microscopes paid for by the IAEA were received and forwarded to Stephen Hight and Jim Carpenter, and will also go to the program office when established.

**PPQ FIELD ACTIVITY**: Maurice Duffel was detailed from the Citrus Canker program along with other program workers, Buddy Cheslock and Carl Lightfoot to work with Stephen Hight in Ft. Morgan and Bon Secour removing infested *Opuntia* material. In the last two weeks of the month, they removed and destroyed over two tons of host material. Maurice also began looking in the Pensacola area for a program office.

LIAISON. Stephanie Bloem was responsible for collecting and blending all program and research reports for March. The document was then translated into Spanish for distribution to SAGARPA/SENASICA officials.

## RESEARCH

### Stephen Hight, USDA-ARS-CMAVE Laboratory, Tallahassee, Florida

SIT VALIDATION. Monitoring with pheromone baited-traps (experimental lures) has been ongoing for 1½ years at 4 SIT validation sites (Dauphin Island, Alabama; Pensacola Beach, Okaloosa Island, and St. George Island, Florida). Infested plant removal was conducted during winter of 2005 at Pensacola Beach and Okaloosa Island. In spring 2005, sanitation efforts were moved from Pensacola Beach to Dauphin Island. Dauphin Island is the current treatment site for "sanitation efforts plus SIT", Okaloosa Island is the site for "sanitation only", and St. George Island serves as the "control site". Moth populations at Pensacola Beach continue to be monitored. Different experiments are being conducted at this site, including initial releases of sterile moths during March-April 2005. The first release of sterile moths for the validation study at Dauphin Island occurred on 26 April 2005.

March Activities: Weekly trap servicing at validation sites began March 15. Servicing includes inspection and replacement of trap components as needed, replacement of sticky bottom if moths are present, and replacement of experimental lure every 2 weeks.

| location | # traps | 1st male capture | egg-sticks |
|---|---|---|---|
| Dauphin Island, AL | 53 | - | - |
| Okaloosa Island, FL | 33 | 23 and 30 March | - |
| St. George Island, FL | 53 | 20 and 30 March | - |
| Pensacola Beach, FL | 70 | 2, 22 and 29 March | 2 on 2 plants on 29 March |

Two additional sites with moderate infestations were identified. Little Dauphin Island is located 50-200 meters north of Dauphin Island. Opuntia are present in limited areas. A boat is needed for access to Little Dauphin Island. Sanitation activities and trap placement started on 7 March 2006. Ft. Morgan is 5 km east of Dauphin Island can be accessed by car ferry. Sterile moths were released at Ft. Morgan on 31 March. APHIS personnel began sanitation efforts at Ft. Morgan (including Bon Secour National Wildlife Refuge) on 21 March 2006.

| location | # traps | 1st male capture | egg-sticks |
|---|---|---|---|
| Little Dauphin Island, AL | 5 | - | - |
| Fort Morgan, AL | | 30 March | - |

ECOLOGICAL AND QUALITY CONTROL FIELD STUDIES. Three annual flight periods have been identified for cactus moth in north Florida – south Georgia. A project to develop a model to predict the flight periods at other locations based on temperature is underway. A preliminary model predicted 4 flights for south Florida and 2 flights for South Carolina. Traps were placed near infestations at 5 locations from the Florida Keys to south of Charleston, SC in March 2005. Temperature loggers are positioned with the traps to record temperature at 30 minute intervals. Traps have been serviced weekly and trap bottoms are shipped to Tallahassee where data is recorded.

March Activities: Due to effects from hurricanes, low moth numbers and inconsistent servicing, traps located on the Florida Keys were removed and replaced with traps and dataloggers at the Guánica Forest Reserve in Puerto Rico (2 March).

PHYLOGENETIC ANALYSIS. Preserved specimens from 4 populations (Puerto Rico, Nokomis, FL and Okaloosa Island, FL – 2 sites) were sent to Dr. R. Brown, Mississippi Entomological Museum, and Dr. T. Simonsen, University of Alberta. Dr. Simonsen is conducting DNA-based phylo-geographical analysis to determine where the U.S. populations have come from, how many times they have been introduced, and how fast the insect is spreading.

TECHNOLOGY TRANSFER TO APHIS. Contact was made 13 March with APHIS personnel implementing the cactus moth control program. Several phone conversations were held to discuss expected outcomes of the work, requirements and mechanics of the work, and suggestions for temporary housing. On 21 March I visited Ft. Morgan (Bon Secour National Wildlife Refuge), Alabama, to meet and discuss the work with APHIS personnel. Tools purchased for $500 were given to APHIS personnel to begin sanitation efforts. We discussed the pest status and impact cactus moth the SIT validation, identification of feeding damage; larvae in pads and pupae between pads and in debris; and implementation area was surveyed. APHIS personnel were trained in servicing traps.

TRAPPING BEYOND THE LEADING EDGE. I re-contacted 4 collaborators – C. May at Grand Bay National Estuarine Research Reserve, Moss Point, MS; G. Hopkins at Gulf Islands National Seashore, Ocean Springs, MS; D. Haynes at APHIS-PPQ, Gulfport, MS; and W. Stablein at Padre Island National Seashore, TX to continue monitoring for cactus moth beyond the leading edge. Trapping supplies were sent to collaborators.

**R. Heath, N. Epsky, USDA-ARS-SHRS Laboratory, Homestead, Florida**

ACCOMPLISHMENTS AND ACTIVITIES. A 6 component blend, including 3 new attractants in addition to the 3 component lure that is currently the best available for cactus moth males, was evaluated in field tests by S. Hight in spring and summer 2005. Component variations of this blend were also tested in fall of 2005 but moth populations were low. To prepare for field tests in 2006 and to understand the behavior when moths are exposed to different lures, flight tunnel

tests were initiated. Tests are conducted in a building with no natural light, under a shifted 12:12 L:D cycle (lights off at 11 pm and on at 11 am). Pupae are sorted by gender and emerged separately. Twenty males (0-2 day old) are used per test. Males are released individually at the downwind end of the tunnel. The behavior is observed for 3-5 minutes and response to the source is determined to be oriented flight, hovering and landing. One replicate of responses to 6 treatments (live females, 2 doses of the standard blend, and 1 dose of the 4, 5 and 6 component blends) has been completed.
Mating studies to compare behavior under shifted light cycle with behavior in rearing light cycle (lights off 8 pm – 8 am) were conducted. Observations were made by filming adults under infra-red light with a low light CCTV camera. Moths were placed in clear plastic vials with aluminum window screen (4-cm diam) at the bottom of the vial and a piece of filter paper along the back wall of the vial to provide foot-hold for the moths. Video output was recorded on a VCR throughout scotophase. Six replicate tests have been completed with 4 pairs recorded per replicate. Mating status of females was determined by dissection to confirm presence of spermatophore. Video analysis is underway.

TECHNICAL PROBLEMS. No pupae have been available from the colonies reared at SHRS or ARS Tifton since mid-March. ARS Tifton will supply pupae the second week of April and SHRS-reared pupae will also be available at that time.

**J. Carpenter, USDA-ARS-CPMRU Laboratory, Tifton, Georgia**

COLONY MAINTENANCE, BUILD-UP AND MASS-REARING.

*SOUTH AFRICAN COLONY*. Egg sticks were field-collected in South Africa and received in Tifton on 26 October 2005 (225,000 eggs). Egg hatch was approximately 75% resulting in about 150,000 neonates that were set-up on artificial diet (27 October – 14 November). Collection of pupae and adult emergence occurred between late December 2005 and early January 2006. Eggs collected from the first generation reared on diet totaled 228,667. This colony had a mean percent emergence from pupae of 77.4% and a mean of 24 eggs per female.

*U.S. COLONY*. Eggs collected during January 2006 - 88,963. Eggs collected during February - 151,400.

Eggs set-up from the first week of January should emerge as adults in early April for irradiation and field release.

| | South Africa | | | | U.S. | | | |
|---|---|---|---|---|---|---|---|---|
| January | eggs collected | eggs on diet | late instar lost to virus | did not feed | eggs collected | eggs on diet | late instar lost to virus | did not feed |
| 3-11 | 77,901 | | | 77,400 | 19,237 | | | 49,000 |
| 16-20 | 72,580 | | | | 39,060 | | | |
| 23-27 | 78,186 | | | | 30,666 | | | |
| total | 228,667 | | | | 88,963 | | | |
| February | | | | | | | | |
| 3-10 | | 13,400 | | | | 75,000 | | |
| 14-21 | | 15,000 | | | | 43,320 | | |
| total | 48,800 | | | | 151,400 | | | |
| March | | 128,000 | 14,000 | 2,500 | | 19,000 | 23,000 | 5,500 |

Diet prepared for rearing January 240 liters; February 150 liters; March 195 liters. Over 1200 containers are currently being handled each week.

REARING PROBLEMS. Larvae emerging from eggs from both colonies set-up between January 3-16 failed to feed on the diet. We identified a change in the diet mixing for mass production as the problem. As a consequence, diet mixing has been changed back to the original 4 liter blender which gives the diet a smoother texture. Neonate larvae now appear to be feeding normally.

Received an additional 375,000 eggs from South Africa on 9 March 2006; all eggs were placed on diet by March 28, 2006.

Current estimate of size of South Africa colony – 424,000
Current estimate of size if U.S. colony – 180,000

A manuscript describing viruses found in the cactus mot has been submitted to the Journal of Invertebrate Pathology: Orville G. Marti, Eloise L. Styer, Ronald L. Myers, and James E. Carpenter. Viruses in a laboratory-reared colony of the cactus moth, *Cactoblastis cactorum* (Lepidoptera: Pyralidae).

REARING STUDIES. The current artificial diet consists of white kidney beans (protein source), brewer's yeast (protein source and some vitamins), cholesterol (1g/liter), and other components necessary for mold control and diet presentation. Cactus moth development is adequate; however, we continue to look for ingredients to improve pupal size and female fecundity. Currently, we are evaluating diets with varying concentrations of fatty acids and vitamins. Diet trials include (A) cholesterol (0, 1, 2, and 4 grams/liter), (B) carrot powder (0, 10, 20, and 30 grams/liter), (C) cactus powder (0, 10, 20, and 30 grams/liter), (D) Vanderzant vitamin mix (0, 10, 20, and 30 grams/liter), (E) several proportions of powdered egg/ Brewer's yeast (0, 25, 50, 75, and 100%). Egg sticks (≈100 eggs) are placed in rearing containers with cladodes or with

different test diets. Rearing occurs at 29°C and 60% relative humidity, and 14:10 (L:D) h photoperiod. Each treatment is replicated 4 times. Percentage egg hatch, larval, pupal, and overall survival, pupal weight, and developmental time (larval, pupal, and overall) is recorded. Resulting adults are paired randomly in cups with a small piece of *O. ficus indica* for mating and oviposition. Cups are kept at ambient temperature until all moths die. Number of eggs and egg sticks will be counted. Egg sticks will be held at above conditions until hatch. Percentage egg hatch will be recorded. In addition, moth longevity will be recorded and females will be dissected to verify mating.

ECOLOGICAL AND QUALITY CONTROL STUDIES. A technique to determine the mating status of male cactus moths has been developed. It will allow us to compare mating competitiveness of irradiated/released males with wild males captured in traps. It also will allow us to determine if wild males captured in pheromone-lure traps are mostly virgin (indicating that female cohorts have not yet emerged) or mostly mated. A manuscript is in preparation (Orville G. Marti and James E. Carpenter. A character demonstrating the occurrence of mating in male *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae)).

SIT VALIDATION. On 31 March a release of 443 irradiated male moths was made at Fort Morgan, AL.